# A REVIEW OF THE INDIAN SPECIES OF *HOMALOTYLUS* MAYR (HYMENOPTERA: ENCYRTIDAE)

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**M.PHIL. DISSERTATION**

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# CERTIFICATE

I certify that the dissertation entitled "**A Review of the Indian Species of *Homalotylus* Mayr (Hymenoptera : Encyrtidae)**" contains the original work done by **Miss Shoeba Binte Anis**. The work was carried out by the candidate under my supervision. I allow Miss Shoeba Binte Anis to submit it to the Aligarh Muslim University, Aligarh, in partial fulfilment of the requirements for the award of the Degree of **MASTER OF PHILOSOPHY.**

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Reader

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# INTRODUCTION

The species belonging to the Coccinellidae (Coleoptera), commonly called "coccinellid beetles" or lady bird beetles are generally predators on homopteran insects such as aphids and coccoids. Coccinellid larvae and adults feed upon these homopterans and thus help to keep these pest species in check in nature. Because of these predatory habits, coccinellids are used in the biological control of mealybugs, soft scale insects and aphids. The best example, and the one often quoted in biocontrol literature is the introduction into California of *Rodolia cardinalis* Mulsant, from Australia for control of the cottony cushion scale, *Icerya purchasi* Maskell, (Clausen, 1940).

The immature stages of coccinellids are parasitized by a variety of hymenopteran parasitoids, especially those belonging to the chalcidoid families Encyrtidae, Eulophidae, Eupelmidae and Pteromalidae, apart from other hymenopterans (Braconidae) and dipterans (Tachinidae, Phoridae). These parasitoids are usually reared along with the pest species (coccoids, aphids), and are sometimes erroneously considered as primary parasitoids of the pest species (Domenichini, 1957; Klausnitzer, 1976). Being parasitoids of predators of economically important pest species, these insects play a negative role in the biological control of pest species, and

are, therefore, considered harmful. Inspite of these facts, a taxonomic study of these parasitoids is essential, if for no other reason than to warn biocontrol workers about their true nature.

Among the parasitoid fauna of the lady bird beetles, the species of the encyrtid genus *Homalotylus* Mayr, form a dominant group, and compared to members of other hymenopteran families, these are almost invariably reared in large numbers, from larvae and pupae of coccinellids found in association with mealy-bugs, soft scales and aphid colonies.

The present dissertation deals with the taxonomic identities of the Indian species of *Homalotylus*. The systematic position of the Indian species is discussed and the species are diagnosed. In all a total of 10 species are presently recognized as occurring in India. Of these 2 species are recorded from India for the first time, and 3 specific names are placed in synonymy. One species, *magniclavus*, is transferred to *Aphycus*. There is also a key for the identification of the Indian species.

## HISTORICAL REVIEW

The genus currently contains 39 world species excluding synonyms proposed in this work. The actual number of valid species cannot be determined accurately as the genus has not been revised since 1919, and there is some difference of opinion on the validity of a few species. The only available revision of the world species of *Homalotylus* was published 75 years ago (Timberlake, 1919). Later several authors published smaller papers describing a few species. Among these the following may be mentioned: Gahan (1920) on one species from the Philippines; Hoffer (1963) on some species from the former Czechoslovakia; Tachikawa (1969) on Japanese species, and Myartseva, (1981) on species from Turkmenia. More recently Trjapitzin (1989) gave a key to *Homalotylus* species of the Palaearctic region.

The first species in this genus from India, *H. flaminius*, was recorded in 1934 by Ayyar & Margabandhu. Later this same species was recorded by several authors from various localities and hosts. This was followed by records of *H. terminalis* (Say), by Kapur (1942) & Bhatnagar (1952), and of *H. mexicanus* Timberlake , by Kurien (1953). In 1966, Agarwal described *indicus* in his new genus, *Neoaenasioidea*, and in 1970 he added two more species, *nigritus* and *albiclavatus*, to this genus.

Hayat et al (1975) synonymised *Neoaenasioidea* with *Homalotylus*, described one species as new (*ferrierei*), and reported *flaminius*, *nigritus*, *indicus* and *albiclavatus* from material collected from some localities in India. A year later, Khan (1976) described *albiscutellaris* as a new species and gave further records of *nigritus*, *indicus* and *albiclavatus*, but placed all these species in *Neoaenasioidea*. Hayat (1981) further commented upon the systematic identity of *Neoaenasioidea*, and synonymized *N. albiscutellaris* Khan, with *H. albiclavatus* (Agarwal).

Hayat & Subba Rao (1981) catalogued the known species of *Homalotylus* from India, and further transferred *Prochiloneurus nipaecocci* Subba Rao to this genus. Shafee & Fatima (1984), following De Santis (1964) placed all the species of *Homalotylus* in *Echthroplexis*, considered *Homalotylus* as well as *Mashhoodiella* as its synonyms, and described two species, *tumkurensis* and *longipedicellus*. In 1989, Fatima & Shafee described another species *magniclavus* under the generic name *Echthroplexis*. Mani's (1989: 871 - 877) revision includes 6 species with brief descriptions and a key. Fatima & Shafee (1994) followed the same generic concept and gave a key to the Indian species. And in a simultaneous publication, Fatima & Agarwal (1994) added

another species, *shafii* again placing it in *Echthroplexis*.

## HOSTS

Species of *Homalotylus* are primary parasitoids of larvae of lady bird beetles (Coleoptera: Coccinellidae), and more rarely of Chrysomelidae (Domenichini, 1957; Klausnitzer, 1976). They parasitize the larval instars,and the adults usually emerge from the pupae. As indicated elsewhere, these parasitoids play a negative role by killing coccinellids which otherwise act as efficient biocontrol agents against insect pest species. As the hosts of *Homalotylus* species are definitely established, their record as parasitoids of mealy bugs and aphids are undoubtedly erroneous, and indicate that the real hosts which live among these homopterous pests, are overlooked. Although 10 species of *Homalotylus* are known from India, there are definite host records for only 4 species.

## ZOOGEOGRAPHICAL DISTRIBUTION:

The genus *Homalotylus* is cosmopolitan, species being known from all the six zoogeographical regions. The region-wise distribution of the species is as follows: Oriental, 14; Australian, including Pacific ocean Islands, 2 ; Palaearctic, 15; Nearctic, 12; Neotropical, 3; and Afrotropical, 2.

The total number of species recorded from the six regions exceeds the actual number of species (39) because at

least 4 species, *flaminius*, *scymnivorus*, *terminalis*, *turkmenicus*, are recorded from more than one zoogeographical region. Only one species, *flaminius* is cosmopolitan.

## MATERIAL AND METHODS

**Material**: The present study is based on specimens of *Homalotylus* collected during the last several years from various localities in India, and on material received for identification from other institutions. Apart from this, the author has also examined types and determined material of nine species.

**Methodology**: For detail study and identification, specimens were mounted on rectangular cards, and also were dissected and mounted in balsam on glass slides. For both, the procedure given by Noyes (1982) was adapted. Body colour, sculpture and setation were studied from carded specimens, whereas other details were studied from slide mounted specimens.

Drawings were made with the help of a drawing tube attached to a compound microscope.

Measurements of various slide mounted body parts were taken with the help of an ocular micrometer having a linear scale of 100 divisions, placed in the eye-piece of a microscope. Total body length and other measurements from carded specimens were taken with the help of an ocular-micrometer placed in one of the eye-pieces of a stereoscopic binocular microscope.

**Terminology**: The author followed the terminology given by Noyes & Hayat (1984). This is further explained in the figures given here (Figs. 1 - 11).

## GENUS *HOMALOTYLUS* MAYR

*Homalotylus* Mayr, 1876: 752. Type species *Encyrtus flaminius* Dalman, by designation of Ashmead, 1900: 377.

This well known genus has six other generic names as its synonyms. These are : *Nobrimus* Thomson, *Mendozaniella* Brethes, *Hemaenasoidea* Girault, *Anisotylus* Timberlake, *Lepidaphycus* Blanchard, and *Neoaenasioidea* Agarwal. (see Noyes & Hayat, 1984, Hayat, 1986). Two other generic names *Echthroplexis* Foerster, and *Mashhoodiella* Hayat, considered by some authors as synonyms of *Homalotylus* are discussed in the following pages (see Comments).

The genus can be identified with the help of the keys to genera given by Noyes & Hayat (1984), Hayat (1986) and Trjapitzin (1989). However, a brief diagnosis of the genus is given here.

**Diagnosis**: Relatively large-sized encyrtids, measuring 1.5 - 2.0 mm in length, with flatter habitus, long and slender legs, and presence of an infuscate patch in the disc of the forewing.

**Female. Head** with frontovertex convexly curved and gradually merging with face, its width less than 0.33X of head width; ocellar triangle with apical angle acute, or an

equilateral triangle; posterior ocelli very close to eye margins; scrobes short, neither deep nor sharply margined; toruli near mouth margin; eye kidney - shaped,long,dorsally nearly reaching occipital margin; malar space short, not longer than eye width and generally with a weak malar sulcus. **Mandibles** 3- dentate, teeth sharp, middle tooth slightly longer, or middle and/or dorsal tooth rounded. **Maxillary** palp 4-segmented, Labial palp 3-segmented. **Antenna** with a 6-segmented funicle; clava usually 3 segmented, with truncation but because of white colour, segmentation sometimes obscure; funicle segments closely articulated.

**Thorax** somewhat flatter or slightly convex; pronotum entire, with posterior margin slightly concave; mesoscutum with complete notaular lines; axillae mesally meeting; scutellum with apex narrowly rounded and overlapping metanotum; propodeum narrow in middle but longer than metanotum, with fine submedial ridges, spiracles located near anterior margin of propodeum. **Forewing** long and narrow; marginal vein quadrate to slightly longer than broad; post-marginal length variable; stigmal vein long, forming an angle of about 30° - 35° with anterior wing margin; stigma with 4 circular sensilla; disc densely and finely setose, with a distinct, though narrow, linea calva; discal setae brown except in about basal third (except extreme base) and an oval

area in disc distad of infuscation, with transparent setae. **Hind wing** generally broad, with hyaline discal setae. Legs long and slender; mid tibial spur elongate and usually provided with 'pegs'as on tarsal segments; hind femora and tibiae slightly flattened. **Petiole** narrow and transverse.

**Gaster** with TI (first tergum) longer than other terga; terga II - V or VI with a medial inflexion; T VII much broader than long; cercal plates situated in distal third to fourth of gaster; hypopygium reaching at least to apex of gaster; ovipositor variable, shorter and unexserted,or long and strongly exserted at apex.

Head finely reticulate and sometimes with fine punctations; mesoscutum finely reticulate; axillae and scutellum with raised reticulate sculpture, appearing 'granular' or 'punctate - reticulate', and hence dull, as compared to the shiny mesoscutum; gasteral terga with fine reticulation. Setae on head variable, white to pale brown; those on mesoscutum usually white, and on axillae and scutellum brown to dark brown or golden brown; sides of propodeum with dense silvery white setae.

Colour variable, completely dark brown to black with metallic shine to partly yellow (ochraceous, testaceous) to dusky brown. Colour of antennal segments variable, atleast clava white or largely so. Forewing almost always with infuscation in about middle third. Leg colour variable,

nearly completely dark brown to yellow with brown to dark brown suffusions.

**Male.** Sexual diamorphism very little. It is difficult to differentiate the sexes in species with an unexserted ovipositor. Antennal scape in some species with a concavity on dorsal surface. T VII of gaster relatively longer, cercal plates situated at about distal third of gaster. External genitalia with a tubular phallobase, with aedeagal apodemes contained within the phallobase; parameres absent/ reduced; digiti well - developed, each digitus usually with three denticles.

**Comments:** The synonymies noted above under *Homalotylus* are now well - established and there is no need to comment on these. The use of the name *Echthroplexis* Foerster by some authors (De Santis, 1964, Not, 1979; Shafee & Fatima, 1984; Fatima & Shafee 1989, 1994; Fatima & Agarwal 1994), however, is unjustified, and rests on the premise that *E. ephippium* Ruschka ( = *Homalotylus ephippium*) is the type species of *Echthroplexis*. Graham (1969) has shown that the designation of *Caenocercus puncticollis* Thomson as the type species of *Echthroplexis* is a valid designation according to the Code [Articles, 67K, 69(a) (ii)]. This should settle the status of *Echthroplexis* as a genus different from *Homalotylus*.

*Mashhoodiella*: Shafee & Fatima (1984) placed *Mashhodiella* Hayat (1972) in synonymy with *Echthroplexis sensu* De Santis 1964 (= *Homalotylus*). This synonymy is not accepted here as *Mashhoodiella* differs from *Homalotylus* in several characters (forewing venation and discal setation, location of cercal plates, shape of T VII of gaster, and shape of the hypopygium), *Mashhoodiella* probably does not belong in the Tribe Homalotylini. Therefore, the genus *Mashhoodiella* is reinstated as a valid taxon (nom. rev.).

**Classification**: *Homalotylus* was placed in the Tribe Homalotylini and subtribe Homalotylina by Hoffer (1954) (see also Trjapitzin 1973, Noyes & Hayat, 1984). This subtribe also includes *Homalotyloidea* Mercet, *Isodromus* Howard, *Eupoecilopoda* Erdos & Novicky, and *Copidosomyia* Girault.

**Key to Indian Species of *Homalotylus*, Females**

1. Ovipositor sheaths (third valvulae) not exserted, if slightly so, then third valvula not more than 0.25X of second valvifer. [Body and legs, excluding tarsi, completely dark brown to black, at least partly shiny]. ---------- 2

- Ovipositor sheaths exserted, exserted part at least 0.25X of length of gaster or third valvula at least 0.33X of second valvifer ---------- 6

2. Pedicel nearly 3X as long as broad and as long as F1 and F2 combined (Fig. 12) [Only F6 and clava white]. ---------- 1. *longipedicellus* (Shafee & Fatima)

- Pedicel atmost 2X as long as broad, usually not as long as F1 and F2 combined, rarely as long as F1 and F2 combined ---------- 3

3. Head, in front view, not appreciably longer than broad; [Head and venter of thorax yellowish brown, head sometimes with a bronzy lustre; only clava white; hind tarsi dark brown] ----------
---------- 2. *terminalis* (say)

- Head, in front view, oval, longer than broad ----- 4

4. Funicle segments quadrate to broader than long; body brownish yellow ---- 3. *tumkurensis* (Shafee & Fatima)

- At least basal funicle segments longer than broad; body largely dark brown ---------- 5

5. Funicle segments all longer than broad, F1 2X as long as broad; scutellum ochraceous yellow; legs largely yellowish brown or yellow, hind tibiae and tarsi dark brown; F6 and clava white ---------- ---------- 4. *mexicanus* Timberlake

- Distal funicle segments usually not longer than broad, F1 less than 2X as long as broad (Fig. 16); scutellum dull, black; legs largely dark brown including hind tarsi --------- 5. *flaminius* (Dalman)

6. Body completely dark brown to nearly black, and partly with metallic shine; hind legs excluding tarsi, dark brown ---------- 7

- Body not completely dark brown; most of head, largely the axillae and scutellum, and sides of thorax yellow or yellow brown,occasionally with pale fuscous suffusions; hind legs, excluding tarsi, not completely dark brown ---------- 8

7. Head in front view about as broad as long or

broader; frontovertex about 0.25X of head width (Fig. 25); only clava white (Fig. 26); mid legs excluding tarsi, completely infuscate brown to dark brown ---------- 6. *turkmenicus* Myartseva

Head, in front view, longer than broad and/or frontovertex narrow, less than 0.25X of head width (Fig. 1); mid legs, excluding tarsi, not completely dark brown ---------- 8

8. Body more or less completely dark brown except occasionally part of frontovertex and partly the scutellum, testaceous yellow; hind legs, excluding tarsi, completely dark infuscate brown; F5, 6 and clava white ---------- 7. *scymnivorus* Tachikawa

Body colour different, head, largely axillae and scutellum, mostly sides of thorax yellow, occasionally with pale fuscous suffusions; either hind legs, excluding tarsi, not completly dark infuscate brown or antennal colour different ------9

9. F4 - 6 and clava white; pedicel as long as F1 and F2 combined (Fig. 34) -------- 8. *ferrierei* Hayat *et al*

Atmost F6 and clava white; pedicel usually shorter than F1 and F2 combined; at least basal funicle

segments slightly longer than broad ---------- 10

10. Flagellum with F6 and clava white; mesoscutum, propodeum and gaster dark brown ---------- ---------- 9. *albiclavatus* (Agarwal)

- Flagellum uniformly coloured pale yellow with dusky or pale brown suffusions (Fig. 4); mid lobe of mesoscutum, propodeum and gaster distally dark brown ---------- 10. *indicus* ( Agarwal)

1.***Homalotylus longipedicellus*** (Shafee & Fatima)

(Fig. 12 - 14)

*Echthroplexis longipedicellus* Shafee & Fatima, 1984: 373. Female. India, Aligarh (Zool. Deptt. A.M.U.). parts examined. Fatima & Shafee, 1994: 101. key.

*Homalotylus longipedicellus* (Shafee & Fatima): Hayat, 1986: 136.

**Diagnosis.**

**Female.** Length, 2.5 mm. Body dark brown, head with bluish green shine; antenna dark brown with F6 and clava white; forewing with the usual infuscate patch (Fig. 13); legs dark brown except mid tibial spur and basal four tarsal segments. Setae on mesoscutum white, on scutellum brown. Head in front view, slightly longer than broad. Ocellar triangle with apical angle acute, posterior ocelli removed from occipital margin by about four diameters of an ocellus. Antenna as in Fig. 12; note the long pedicel and longer basal funicle segments. Forewing dimension and venation as in Fig. 14. Gaster about as long as thorax. Ovipositor not exserted and with third valvulae short.

Relative measurments. (slide, holotype parts): scape length (width), 64 (10); pedicel length (width), 23, (7); funicle length, 67; clava length, 29; forewing

length (width), 208 (77); ovipositor length 87; third valvulae length 15.

**Male**. Unknown.

**Host**: Coccinellids predaceous on *Aonidiella orientalis* (Newstead) on *Dalbergia sissoo*.

**Distribution**: India: Uttar Pradesh.

**Material examined**: See under comments.

**Comments**: There are two slides, one containing parts of holotype and the second slide with parts of a paratype. In both, head, thorax and part of gaster are missing. These are not located in [the Late] Dr. Shafee's collection. The above diagnosis, therefore, is based upon the original description and the available parts.

The species appears distinctive by the longer pedicel and dimensions of flagellar segements, though apparently close to *flaminius*.

### 2. ***Homalotylus terminalis*** (say)

*Serlion terminalis* Say, 1828: 80

*Homalotylus terminalis* (Say): Timberlake, 1919 : 148. redescription. Kapur, 1942: 56, 60, 65-66 - India. Bhatnagar, 1952: 165. Female. Surat. Hayat *et al*, 1975: 64, key. Hayat & Subba Rao, 1981 : 113. catalogue. Hayat, 1986: 104. catalogue. Mani,

1989: 874. Kanpur.

**Diagnosis.**

**Female.** Structuraly similar to *flaminius* except as follows : Head and venter of thorax brownish yellow, rest of body black; head with bronzy shine; mesoscutum with greenish shine; propodeum and gaster with bluish shine; antenna dark brown, clava white; forewing as in *flaminius*; legs pale to dark brown, mid femur brownish yellow, mid tibial spur and tarsal segments yellowish white.

Head about as long as broad in front view; otherwise similar to *flaminius*; F1 slightly longer than broad, F6 quadrate. Postmarginal vein of forewing slightly shorter to slightly longer than stigmal vein.

**Male.** Similar to female, except forewing infuscation relatively less distinct.

**Hosts**: *Chilomenes sexmaculatus* (Fab.); *Scymnus quadrillum* (Sicard).

**Distribution**: India: Gujarat, Uttar Pradesh (Nearctic).

**Comments**: This species is unknown to the author. The above diagnosis and the key characters are noted from the redescription given by Timberlake (1919). It was recorded from India by Kapur (1942) and Bhatnagar (1952).

### 3. ***Homalotylus tumkurensis*** (Shafee & Fatima) ***incertae sedis***

(Fig. 15)

*Echthroplexis tumkurensis* Shafee & Fatima, 1984: 375. Female. India, Tumkur (Zool. Deptt. A.M.U). parts examined. Fatima & Shafee, 1994: 101. Key.

*Homalotylus tumkurensis* (Shafee & Fatima) : Hayat, 1986: 137.

**Diagnosis.**

**Female**. Length, 1.6 mm. Body colour (described as) reddish brown; antenna yellowish brown, clava white; forewing with the usual infuscation in middle third of disc; legs reddish brown with mid tibial spur and tarsal segments white.

Ocelli arranged in an equilateral triangle, posterior ocelli about two ocellar diameters to occipital margin. Antenna as in Fig. 15; note the short, quadrate to broader than long funicle segments. Gaster slightly shorter than thorax. Ovipositor not exserted.

**Male**. Unknown.

**Hosts**: Coccinellid predaceous on *Coccus* sp. on *Mangifera indica* L.

**Distribution**: India: Andhra Pradesh.

**Comments**: The holotype now consists of only one antenna and

one damaged forewing on a slide, rest of the body not found in Shafee's collection. The original description obviously was based upon a specimen whose colour has faded due to long preservation in alcohol. (The specimen was collected in 1968). Otherwise this species may eventually prove to be an extreme variant (short flagellar segments) of *flaminius* (Dalman).

**4. *Homalotylus mexicanus*** Timberlake.

*Homalotylus mexicanus* Timberlake, 1919: 155. Female. Mexico, Guadelajara (U.S. National Museum. Washington, D.C.). Kurien, 1953: 121. Female. Bangalore. Hayat & Subba Rao, 1981: 113. catalogue. Hayat 1986:104.

**Diagnosis**.

**Female**. Body largely brownish black, with head, venter of thorax, pronotum except collar, and venter of gaster yellowish brown; scutellum ochraceous yellow; frontovertex with bronzy and mesoscutum with greenish shine; antennae brownish white; forewing infuscated as in *flaminius*; fore and mid coxae, femora and middle tibia ochraceous yellow; coxae and fore femora slightly suffused with brownish; proximal half of mid tibia brownish; fore tibia and tarsi, hind coxae and femora on outer surface pale yellowish brown; hind legs otherwise dark brown; mid tibial spur and tarsal

segments 1 - 4, white. Structurally similar to *flaminius*. Pedicel 1.33X as long as broad, F1 2X as long as broad, F2 - 4 about 1.5X as long as broad, F5 and F6 slightly shorter than F4; clava slightly shorter than F4 - 6 combined. Postmarginal vein nearly as long as stigmal vein.

**Male**. Unknown.

**Hosts**: *Chilocorus nigritus* (Fab.).

**Distribution**: India: Karnataka (Neotropical: Mexico)

**Comments**: This species is known to the author from the original description of Timberlake (1919). It was recorded from India by Kurien (1953). The above diagnosis and key characters, therefore, are drawn from the original description.

### 5. ***Homalotylus flaminius*** (Dalman).

(Figs. 8,10,16 - 19)

*Encyrtus flaminius* Dalman, 1820 : 340.?Male. Sweden. (Nat. Riks. Stockholm, not found *teste* Graham, 1969).

*Neoaenasioidea nigritus* Agarwal, 1970:27. Female. India, Aligarh (Zool. Deptt. A.M.U.), examined. **syn. nov.**

*Homalotylus flaminius* (Dalman): Mayr, 1876:752. Ayyar & Margabandhu, 1934:194. Coimbatore. Mani, 1938:89. Delhi, catalogue. Pruthi & Mani, 1940:14, hosts, biology. Kapur 1942: 56, 60, 65 - 66. Venkatraman, 1946:527. Coimbatore. Subramaniam, 1950:103, 104, 106. Bhatnagar, 1952:165, Female, Male. Bangalore. Mani & Kurien 1953:14. Kurien, 1953:121. Female, Male. Bangalore. Subramaniam 1955:110, 117. Hayat *et al* 1975:65. Female, Male. Guntur. Avasthi & Shafee 1977:120. host. Hayat & Subba Rao 1981:113. catalogue. Hayat, 1986:103 - 104. catalogue. Mani 1989:872. description.

*Homalotylus nigritus* (Agarwal): Hayat *et al* 1975:65. [Transfer of species only, not the material recorded under this name].

*Echthroplexis flaminius* (Dalman): Shafee & Fatima, 1984:373. list. Fatima & Shafee, 1994:100, Key.

**Diagnosis.**

**Female**. Length, 1.50 - 1.65 mm. Body dark brown to black; frontovertex and temples with green and bronzy shine, pronotum and mesoscutum with greenish to bluish green reflections; axillae dull bronzy; scutellum matt with some shine; tegulae

white in about basal half, brown in distal half; propodeum and gaster with dull green to bronzy shine; antenna dark brown to blackish, with clava and rarely F6 partly or completely white; forewing infuscation as in Fig. 17; the basal patch with dark setae small; legs including coxae blackish brown, slightly shiny; tarsal segments 1 - 4 of mid leg and mid tibial spur white to yellowish white. Setae on head sparse and white, on mesoscutum silvery white; setae on axillae and scutellum brown, the dense pile on each side of propodeum silvery white.

Structural details as in Figs. 8,10,16-19; but the following may be noted: Frontovertex about one fourth of head width, or slightly more broader; ocellar triangle with apical angle slightly acute, OCL (distance between posterior ocellus and occipital margin) slightly less than OAL (distance between a posterior ocellus and anterior ocellus); mandibles apically broader. Antenna generally with funicle segments longer than broad, F6 nearly quadrate (Fig. 16). Ovipositor short not exserted at apex, shorter than mid tibia.

Relative measurements (from card): Head width, 42; minimum frontovertex width, 11.5; POL, 6; OCL, 5; OAL, 6. (from slide): Head frontal width, 82; head length, 87; frontovertex width, 21; scape length (width), 59 (8); pedicel length (width), 17 (7.5); funicle length, 68; clava length, 30; forewing length (width), 92 (34); mid tibia length, 130; mid tibial spur length, 51; mid basitarsus length, 48; ovipositor length,77;third valvulae length,11.

**Male.** Similar to female, except relatively smaller in size; antennal scape normal, without concavity on dorsal surface.

**Hosts:** *Adonia variegata* (Goeze); *Brumoides suturalis* (Fab.); Chilocorus sp.; *Chilomenes* sp. *Menochilus sexmaculatus* (Fab.); *Rodolia* spp.; *R. cardinalis* (Mulsant); *R. fumida* (Mulsant); *R. guerni* (Crotch) ( = *Novius guerni*) Indet. coccinellids predaceous on *Drosicha stebbengi*; *Icerya purchasi* (Maskell); *I. pilosa nordi* (Green); *Lecanium* sp. on Jack *Artocarpus heterophyllus*; *Nipaecoccus viridis* (Newstead) on *Citrus medica* L.; aphids on cabbage.

**Distribution:** India: Andhra pradesh, Delhi, Karnataka, Uttar Pradesh, Tamil Nadu (cosmopolitan).

**Material examined:** INDIA : Uttar Paradesh, Aligarh. 1 Female, 12.ii.1980, M. Verma; 1 Female, 13.xi.1979, M. Hayat; 1 Male, 4.i.1980, M. Hayat & M. Verma; 1 Female, 12.iii.1985, M. Hayat; 1 Female, March, 1980. M. Hayat; 1 Male, 15.1.1980, M. Verma. Delhi, IARI, 1 Female, March, 1979, C.R. Roy. Tamil Nadu, Villupuram, 1 Male, 19.ii.1993, S.B. Zeya. Karnataka, Bangalore, 5 Females, 3 Males, 20.iii.1995, S.J. (12) PDBC., ex *Menochilus sexmaculatus*.

**Comments:** *H. nigritus* : The holotype examined. Hayat *et al* (1975), Khan (1976), Shafee & Fatima (1984) and Fatima & Shafee (1994) wrongly interpreted this species as having an exserted ovipositor whereas Agarwal (1970) correctly stated that the third valvula is short. However, the holotype of *nigritus* is indistinguishable from *flaminius*, and therefore it is placed in synonymy with the latter species.

*H. flaminuis* is a well - known, cosmopolitan species. The types of this species are probably lost (Graham, 1969) and, therefore, the identity of the Indian specimens is based upon the redescription given by Timberlake (1919).

### 6. ***Homalotylus turkmenicus*** Myartseva

(Figs. 2, 5-7, 9,11, 25-29)

*Homalotylus turkmenicus* Myartseva, 1981: 38. Female, Male.

Turkmenia (Zool. Inst. St. Petersburg) not examined. Trjapitzin, 1988: 363. Key.

[*Homalotylus nigritus* (Agarwal): Hayat *et al*, 1975: 65. Female, Male. Aligarh, Hissar, Hoshiarpur, Patiala, Phillaur. Hayat, 1977: 167. Female, Male, Pali. Mani, 1989: 874. misidentification].

[*Echthroplexis nigritus* (Agarwal): Shafee & Fatima, 1984: 375, Female. Aligarh. Fatima & Shafee, 1994: 102, Key. misidentification].

**Diagnosis.**

**Female**. Length (excluding exserted part of ovipositor), 1.45-1.80 mm. Body blackish brown, shiny, head with some greenish and faint bronzy shine, facial area, scrobes and malar space below, testaceous yellow to dusky; Pronotum anterior half on sides dusky yellow; mesoscutum slightly greenish; axillae and scutellum matt, black; tegulae white with apical third brownish; third valvula brown at least in apical third; antenna blackish brown, clava white; forewing infuscate as in Fig. 5; basal infuscate patch with dark setae relatively larger; legs dark brown to blackish, tarsal segments 1-4 of mid legs, 1-4 or 1-3 of hind legs, and mid tibial spur white. Body setae

as in *indicus* (Agarwal), except setae on axillae and scutellum varying from nearly white to pale brown.

Structural details as in Figs. 2, 5-7, 9, 11, 25-29, but the following may be noted: Head rounded in front view, about as broad as long; frontovertex width at least one fourth of head width; ocelli in about an equilateral triangle; OCL slightly more than OAL; mandibles with middle and dorsal teeth rounded. Antenna as in Fig. 26. Ovipositor distinctly exserted at apex, exserted part (depending upon condition of gaster) one-fourth to one-third length of gaster. Ovipositor longer than mid tibia.

Relative measurements (from card): Head dorsal width, 41-46, minimum frontovertex width, 11-12.5; POL, 5-6; OCL, 6; OAL, 5. (from slide): Head frontal width, 75; head length, 73; frontovertex width, 21; scape length (width), 50(6); Pedicel length (width), 15(6); funicle length, 60; clava length, 25; forewing length (width), 155(57); mid tibia length, 93; mid basitarsus length, 39; mid spur length, 37; ovipositor length, 102; third valvula length, 30.

**Male.** Similar to female. Antennal (Fig. 29) scape

without or with a very slight concave dorsal margin.

**Hosts:** Coccinellids predaceous on: *Centrococcus* spp; *Coccidohystrix insolita* (Green); *Nipaecoccus* spp; coccids on *Dalbergia sisso, Zizyphus* sp.; mealy bugs on *Solanum* sp.

**Distribution:** India: Haryana, Punjab, Uttar Pradesh (Palearctic: Turkmania, Iran.).

**Material examined:** INDIA: Uttar Pradesh, Aligarh, 13 Females, 11 Males, August, 1979, with *Coccidohystrix insolita*, M. Verma. Also examined the material reported by Hayat *et al* (1975).

**Comments:** As noted under *H. flaminius*, the holotype of *nigritus* is a synonym of *flaminius*. The material later recorded by several authors under the name *nigritus* is now identified as *turkmenicus*. These specimens run to Myartseva's species in the key to the species given by Trjapitzin (1989). Incidentally this is the first record of *H. turkmenicus* from India.

### 7. ***Homalotylus scymnivorus*** Tachikawa

(Figs. 1, 3, 30-33)

*Homalotylus scymnivorus* Tachikawa, 196: 206. Female, Male.

Japan, Matsuyama (Ehime Univ., Matsuyama), not examined. Trjpitzin, 1989: 364. Key.

**Diagnosis.**

**Female**. Length (excluding exserted part of ovipositor), 1.6 mm (0.3 mm). Body black; head with occiput and vertex infuscate brown; temples and malar space dark brown with dull bluish green shine; frons brownish yellow, interscrobal prominence brownish; mesoscutum with dull green shine, propodeum and gaster shiny, dull violet to bronzy; scutellum matt, black, sides posteriorly sometimes dusky yellow; tegulae white with distal half dark brown; antenna black, shiny, F5, F6 and clava white as in Fig. 30; forewing infuscate as in Fig. 31, basal infuscated area with dark setae relatively large; legs largely dark brown to black as body, mid tibia except basal fourth, and a brown spot at apex, white; mid tibial spur, mid and hind tarsal segments 1-4 white.

Setation on body about as in *flaminius*.

Structural detail as in Figs. 1, 3, 30-33. Relative measurements (from Card): Head dorsal width, 38; frontovertex width, 6.5; POL, 2; OCL, 6; OAL, 5; (from slide): Head frontal width, 66;

head length, 75.5; frontovertex width, 13; scape length (width), 51 (7); pedicel length (width), 16 (6); funicle length, 55; clava length, 27; forewing length (width), 181 (65); hind wing length (width), 126 (37); mid tibia length, 104; mid basitarsus length, 48; mid spur length, 53; ovipositor length, 121; third valvula length, 32.

**Male.** Similar to female, except scape with dorsal margin strongly concave (Fig. 33), and in one Male F4-6 and clava white.

**Hosts:** *Pullus* sp. on Robusta Coffee, *Coffea canephora* Pierre.

**Distribution:** India: Karnataka (Palearctic: Japan).

**Material examined:** INDIA: Karnataka, Chikmagalur, 3 Females, 3 Males, Dec. 1995, ex *pullus* larvae, on Robusta Coffee, *Coffea Canephora* Pierre, K.B. Reddy & M.G. Venkatasha.

**Comments:** The Indian specimens referred here to *scymnivorus* agree in all respect with the description and figures given for this species of Tachikawa (1964). This is a new record for India.

## 8. *Homalotylus ferrierei* Hayat, Alam & Agarwal

(Figs. 34-36)

*Homalotylus ferrierei* Hayat *et al*, 1975. 67. Female India, Nasik (Zool. Deptt. A.M.U.), examined. Avasthi & Shafee 1976: 374. host. Hayat & Subba Rao, 1981: 113, catalogue. Hayat, 1986: 103. catalogue. Mani, 1989. 875, description.

*Echthroplexis ferrierei* (Hayat *et al*): Shafee & Fatima, 1984: 373. Fatima & Shafee, 1994: 102. Key.

**Diagnosis.**

**Female**. Length (excluding exserted part of ovipositor), 1.72 mm (0.21 mm). Body brownish to brownish yellow; frontovertex with bluish green shine and with golden tinge; occiput and interscrobal area fuscous; pronotum dusky yellow, mesoscutum brown, shiny; axillae, scutellum fuscous, metanotum and propodeum dusky; pleura yellow; gaster with sides and distal sternites dark brown and shiny; tip of ovipositor sheaths brownish; antennal radicle, F1 and F2 and base of F3 brown; scape yellow, F4-6 and clava white; forewing infuscate as in Fig. 35; legs yellow, hind tibia and apex of hind femora brownish; mid-

tarsi and spur white.

Head dorsally 1.4X as broad as long; in front view almost rounded, nearly as broad as long; frontovertex, at posterior ocelli, 0.21X of head width; ocellar triangle with apical angle acute; POL: OCL: OAL, 6:8:9.5. Antenna as in Fig. 34. Forewing venation as in Fig. 36.

Relative measurements (slide, holotype): Head frontal length (width), 60 (57); frontovertex width, 11; scape length (width), 43 (5); pedicel length (width), 11.5 (5); funicle length 37; clava length, 21; forewing length (width), 137.5 (51); mid tibia length, 75; mid basitarsus length, 30; mid spur length, 31; ovipositor length, 93; third valvula length, aprox. 30.

**Male:** Unknown.

**Hosts:** Coccinellids predaceous on *Cerococcus* sp. on *Hibiscus* sp; *C.hibisci* (Green) [= *indicus*].

**Distribution:** India: Maharashtra.

**Comments:** This species is very close to *H. oculatus* (Girault) from the Philippines, but differs in body and leg colour, and relative dimensions of funicle segments. (Scutellum yellow; gaster black with brownish venter; antenna blackish brown

with distal half of funicle and clava yellowish white; pedicel shorter than F1 and F2 combined; F1 nearly 1.5X as long as broad, F6 a little longer than broad, in *oculatus*. Redescription given by Timberlake, 1919).

**9.*Homalotylus albiclavatus*** (Agarwal)

(Figs. 20-24)

*Neoaenasioidea albiclavatus* Agarwal, 1970: 27. Female. India, Aligarh (Zool. Deptt. A.M.U.), examined. Khan, 1976: 181, Aligarh.

*Neoaenasioidea albiscutellaris* Khan 1976: 180. Female. India, Aligarh (Zool. Deptt. A.M.U.) examined. Synonymy by Hayat 1981: 21.

*Homalotylus albiclavatus* (Agarwal): Hayat *et al*, 1975: 69. Female, Male. Joginder Nagar, Lakhimpur Kheri, Shencottah, Shoranur. Avasthi & Shafee, 1977: 120. hosts. Hayat, 1977: 167. Female, Male, Pali. Hayat & Subba Rao, 1981: 113, catalogue. Hayat 1986; 103, catalogue Mani, 1989: 875. description.

*Echthroplexis albiclavatus* (Agarwal): Shafee & Fatima, 1984: 371. Fatima & Shafee, 1994:102. Key.

*Echthroplexis albiscutellaris* (Khan): Shafee & Fatima, 1984: 373.

**Diagnosis.**

**Female.** Length (excluding exserted part of ovipositor), 1.40-1.95 mm. Body dark brown except as follows: Head darker yellow to infuscate in part especially on vertex, face and temples, frons pale yellowish brown; pronotum variable, dark brown except sides or yellow with infuscate brown collar; axillae, scutellum, meso and meta pleurum yellow, but darker specimens have axillae and basally scutellum dusky; meso and metapleurum yellowish to nearly completely dark brown; tegulae white with apical third brown; apical 0.25-0.50X of ovipositor brownish, mesoscutum with dull greenish shine; antennal radicle dark brown, scape testaceous yellow, apically dusky; rarely completely brown; pedicel dusky yellow to brownish, F1-5 dark borwn, F6 and clava white as in Fig. 20; forewing infuscate as in Fig. 21; legs yellowish except as follows: Foretibiae and tarsal segments 1-5 brownish; mid femur with a faint brown ring at base; mid tibiae varying from yellow to infuscate brown except yellow at base and distal third; hind femur with a brownish patch in distal half on upper surface or a white strip distally on ventral surface; hind tibiae brown to

dark brown or dark brown with whitish in distal third of dorsal margin; mid and hind tarsal segments 1-4 white, fifth brown; mid spur white; in darker forms coxae brownish and femora more or less completely dark brown. Setation as in other species, but axillae and scutellum usually with brown to golden-brown setae, rarely silvery white. Structural details as given in Figs. 20-24. Relative Measurements (from card): Head dorsal width, 36-39; frontovertex width, 6.5-8; POL, 2-2.5; OCL, 6; OAL, 5. (from slide): Head frontal width 58; head length 65; frontovertex width, 12;scape length (width), 47 (5.5); pedicel length (width), 14 (6); funicle length, 55; clava length, 27; forewing length (width), 55 (55); mid tibia length, 92; mid basitarsus length, 27; mid spur length 40; ovipositor length, 106; third valvula length, 35.

**Male**. Similar to female, except antennal scape with dorsal surface with a concavity and rarely F5 also white (Fig. 24); gaster completely dark brown or with basal half or so yellowish brown.

**Hosts**: Pullus sp. on Robusta Coffee; coccinellids predaceous

on *Coccidohystrix insolita* (Green); *Nipaecoccus viridis* (Newstead), *Pseudococcus* sp. on *Citrus medica* L.

**Distribution:** India. Bihar, Himachal Pradesh, Karnataka, Kerala, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. **Material examined:** INDIA: Uttar Pradesh, Aligarh, 4 Females, 6 Males, various dates between 1979 - 1985, M. Hayat; 1 Female, 7. iii. 1979, M. Verma; 1 Female, 21.i. 1979, M. Verma, (flagella missing). West Bengal, Panagarh, 1 Female, 16.ii. 1994, S.I. Kazmi. Bihar, Ranchi, 1 Female. 27.ii. 1994, S.B. Zeya. Karnataka, Chikmagalur, 2 Females, Dec. 1995, ex *Pullus* larvae on *Coffea canephora* Pierre, K.B. Reddy & M.G. Venkatesha.

**Comments:** *H. albiclavatus* appears close to *H. quaylei* Timberlake (1919), but differs mainly in leg colour and relative dimensions of funicle segments. In *quaylei* legs largely dark brown, and funicle segments quadrate to slightly longer than broad.

### 10. ***Homalotylus indicus*** (Agarwal)

(Figs. 4, 37-39)

*Neoaenasioidea indica* Agarwal 1966: 73. Female. Male, India, Aligarh (Zool. Deptt. A.M.U.), examined. Khan, 1976: 181. Aligarh.

*Prochiloneurus nipaecocci* Subba Rao, 1967:1. Female. India, Delhi (IARI, New Delhi)? Types examined. **Syn. nov.**

*Echthroplexis shafii* Fatima & Agarwal, 1994: 281. Female, **Syn. nov.** Aligarh (Zool. Deptt. A.M.U.), examined.

*Homalotylus indicus* (Agarwal): Hayat *et al*, 1975: 67. Female, Male. Aligarh, Shoranur. Hayat, 1977: 167, Female, Male. Jodhpur, Pali. Subba Rao & Hayat, 1981: 113, catalogue. Hayat, 1986: 104, catalogue. Mani, 1989: 876. description.

*Homalotylus nipaecocci (Subba Rao)*: Hayat & Subba Rao, 1981: 113, catalogue, taxonomy. Hayat, 1986: 104, catalogue.

*Echthroplexis indicus* (Agarwal): Shafee & Fatima 1984: 373. Fatima & Shafee, 1994: 102. Key.

*Neoprochiloneurus nipaecocci* (Subba Rao): Subba Rao, 1976: 688.

**Diagnosis.**

**Female.** Length (excluding exserted part of ovipositor), 1.60 mm. Head yellowish with dusky and slightly shiny vertex, temples pale brownish yellow, pronotum yellow with a small brownish

patch in centre; mesoscutum, except yellow or yellowish brown sides, brownish with dull bluish green shine, axillae, scutellum, pleura and sternum yellowish; metanotum yellowish brown, propodeum dark brown, with faint bronzy shine; tegula white with apical third pale brown; gaster dark brown, shiny, with TI in about basal half yellow, T VI and T VII brownish yellow; third valvula pale brown apically; radicle and scape largely yellow to yellow brown; pedicle and flagellum dusky yellow, becoming pale towards distal end of clava as in Fig. 4; forewing infuscate as in Fig. 38; legs pale yellow to nearly white, except as follows: Fore tibia slightly dusky; mid femora with a brown spot at apex; mid tibiae brownish in proximal half (except base) especially on outer surface; distal four-fifths of hind femur on upper third and hind tibiae except distal fifth and upper third or so, brownish. Setation as in other species. Structural details as in Figs. 37-39.

Relative measurements (from card): Head dorsal width, 38-40; frontovertex width, 7; POL, 4; OCL, 6; OAL, 7; (from slide): Head frontal width, 54; head length, 58; frontovertex width, 11.5; scape

length (width), 37 (5.5); pedicel length (width), 10(5); funicle length, 36; clava length, 21; forewing length (width), 125 (40); mid tibia length, 74; mid basitarsus length, 31; mid spur length, 34; ovipositor length, 100; third valvula length, 30.

**Male.**Similar to female, except antennal scape with a concavity on basal surface (Fig. 37).

**Hosts:***Scymnus* sp. indet. Scymnini. Coccinellids predaceous on: *Coccidohystrix insolita (Green); Nipaecoccus viridis* (Newstead); *Planococcus citri* (Risso), *Rastrococcus iceryoides* (Green), indet. mealybugs.

**Distribution:**India: Delhi, Rajasthan, Tamil Nadu, Uttar Pradesh.

**Material examined:** The material reported by Hayat *et al* (1975) and the types mentioned above.

**Comments:** *P. nipaecocci*: the types are not found in IARI, New Delhi, but the author examined a specimen labelled as this species in Subba Rao's hand writing (*teste* Dr. Hayat) and agreeing with the original data. This specimen thus may actually be a part of the type series. This agrees with the type of *indicus* in all respects, and is, therefore, placed in

synonymy with Agarwal's species.

*E. shafii:* The holotype is on two slides. It is a typical specimen of *indicus*, and hence the above synonymy.

*H. indicus* is a distinctive species, characterized by the shorter funicle segments and dusky yellow colour of the pedicel and flagellum.

## Misplaced Species

***Aphycus magniclavus*** (Fatima & Shafee), Comb. nov.

*Echthroplexis magniclavus* Fatima & Shafee, 1989: 20, Female. India, Aligarh (ZDAMU), examined.

*Echthroplexis magniclavus* was wrongly placed in *Echthroplexis* Fatima & Shafee (= *Homalotylus*). This species as confirmed by study of the holotype, belongs to *Aphycus* Mayr, and is here transferred to that genus as a new combination.

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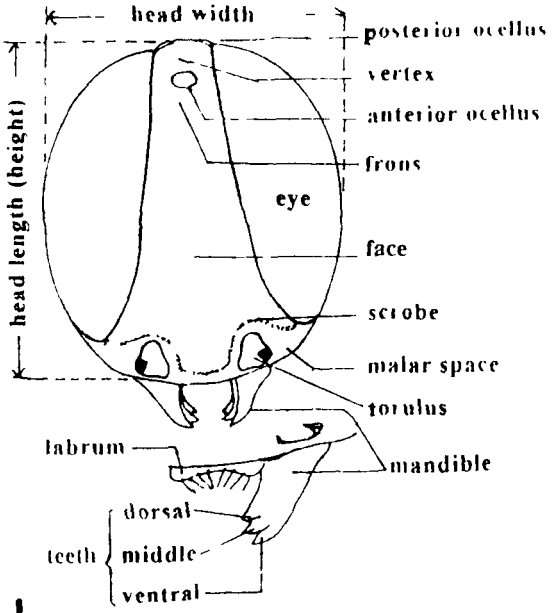
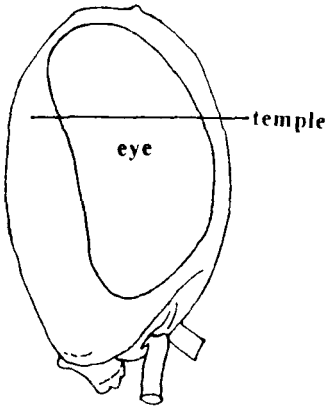
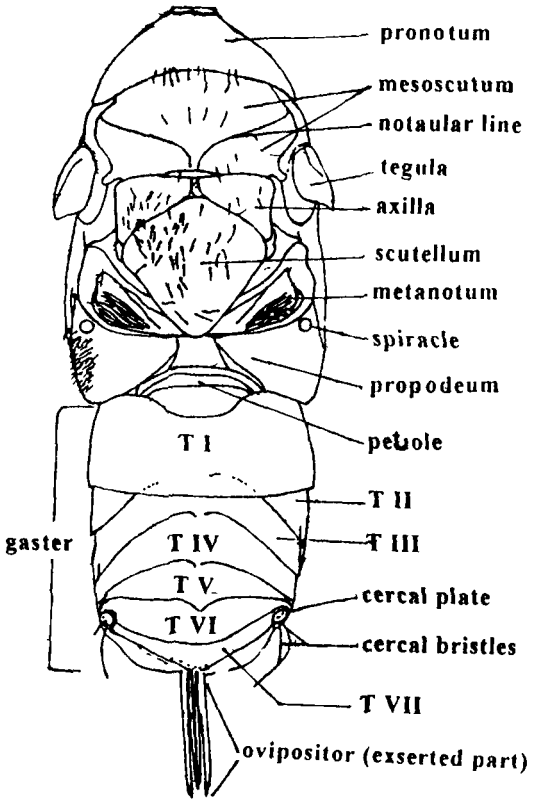
Figs. 1 - 4. Explanation of terms. 1, head frontal with mouth region enlarged, *Homalotylus scymnivorus* Tachikawa, female; 2, head in profile, *H. turkmenicus* Myartseva, female; 3, Thorax and gaster, dorsal, *H. scymnivorus* Tachikawa, female; 4, antenna, *H. indicus* (Agarwal), female.


head width
head length (height)
posterior ocellus
vertex
anterior ocellus
frons
eye
face
scrobe
malar space
torulus
labrum
mandible
teeth
dorsal
middle
ventral

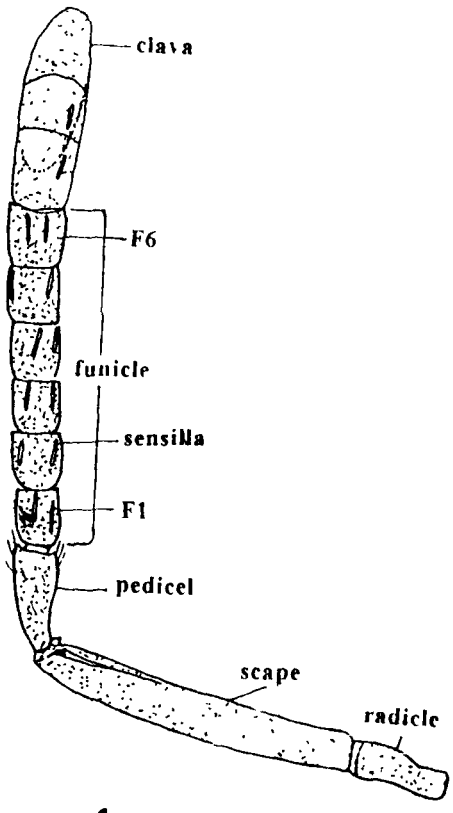
1


temple
eye

2

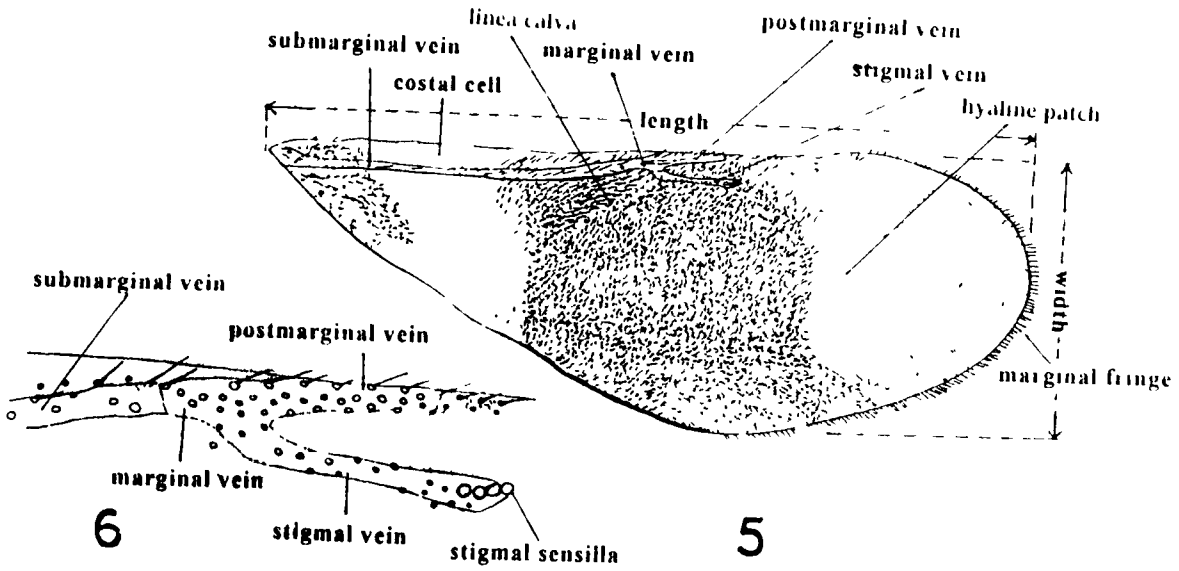

pronotum
mesoscutum
notaular line
tegula
axilla
scutellum
metanotum
spiracle
propodeum
petiole
T I
T II
T III
T IV
T V
T VI
T VII
gaster
cercal plate
cercal bristles
ovipositor (exserted part)

3

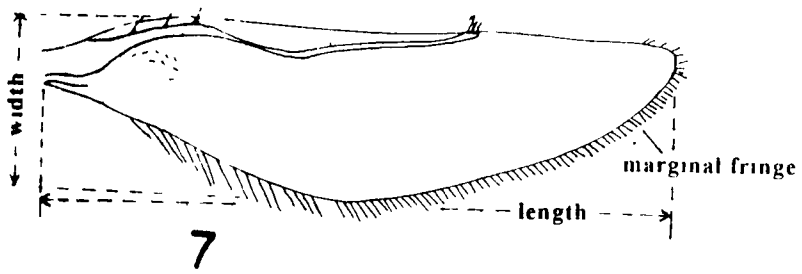

clava
F6
funicle
sensilla
F1
pedicel
scape
radicle

4

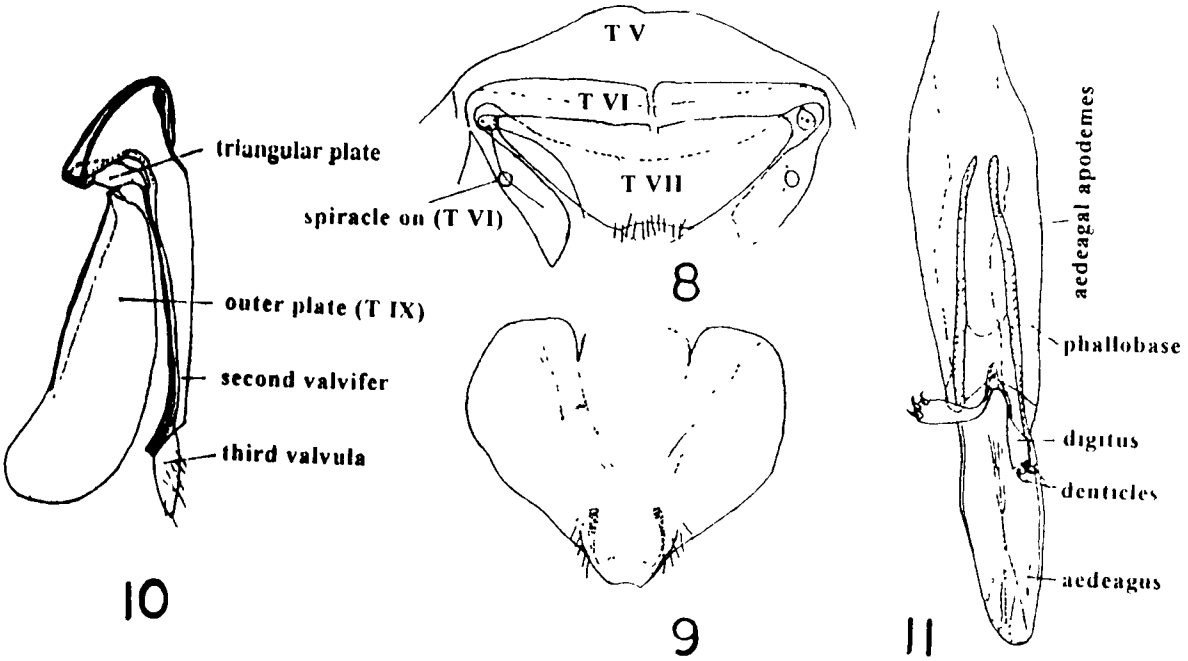
Figs 5 - 11. Explanation of terms. 5, forewing, *H. turkmenicus* Myartseva, female; 6, distal venation of forewing, enlarged, of Fig. 5; 7, hind wing, *H. turkmenicus* Myartseva, female; 8, TV-TVII of gaster, *H. flaminius* (Dalman), female; 9, hypopygium, *H. turkmenicus* Myartseva, female; 10, Ovipositor plates, right half, *H. flaminius* (Dalman); 11, male genitalia, *H. turkmenicus* Myartseva.


submarginal vein
linea calva
marginal vein
postmarginal vein
costal cell
length
stigmal vein
hyaline patch
width
marginal fringe
submarginal vein
postmarginal vein
marginal vein
stigmal vein
stigmal sensilla

6 5


width
marginal fringe
length

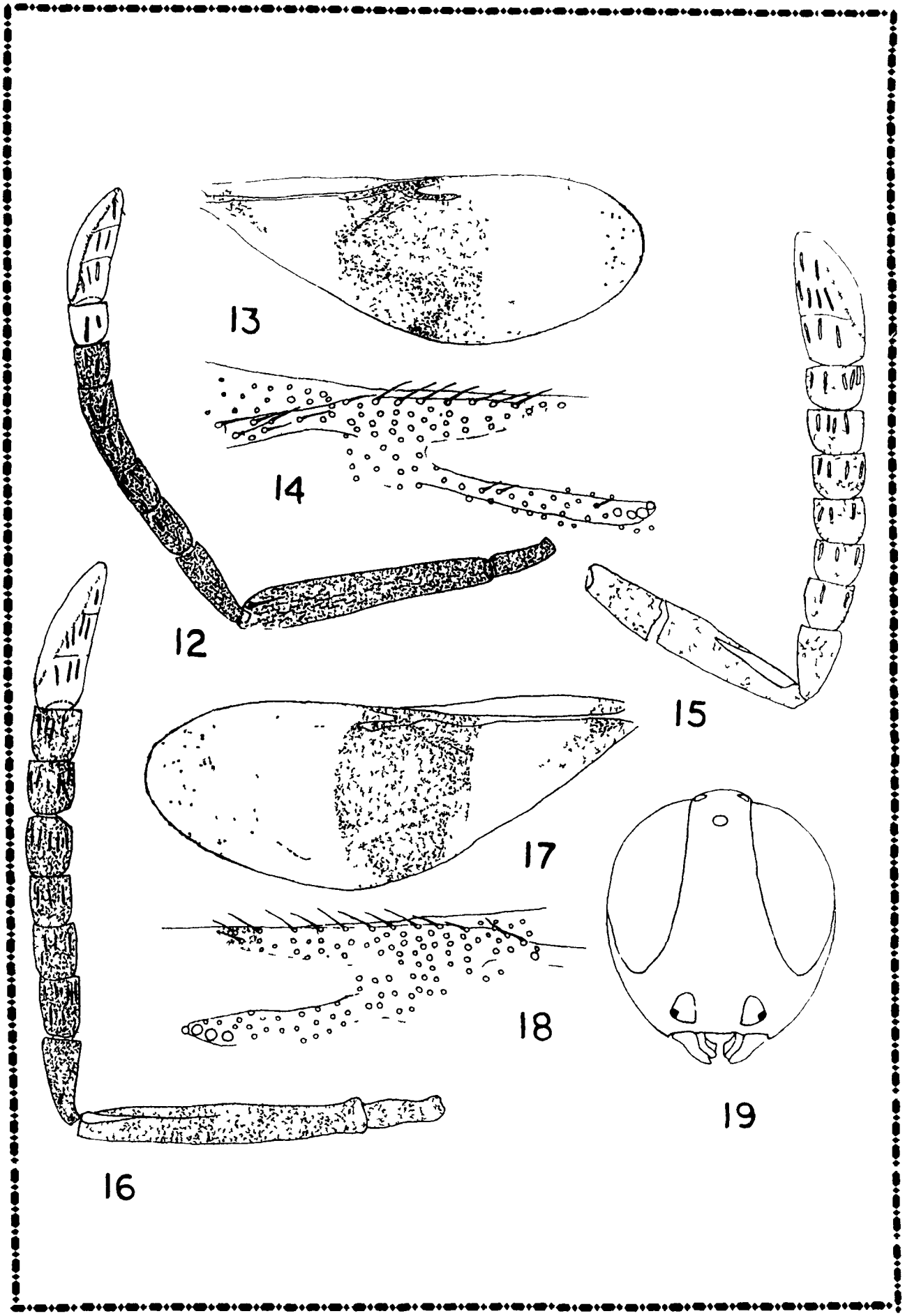
7


T V
T VI
T VII
spiracle on (T VI)
triangular plate
outer plate (T IX)
second valvifer
third valvula
aedeagal apodemes
phallobase
digitus
denticles
aedeagus

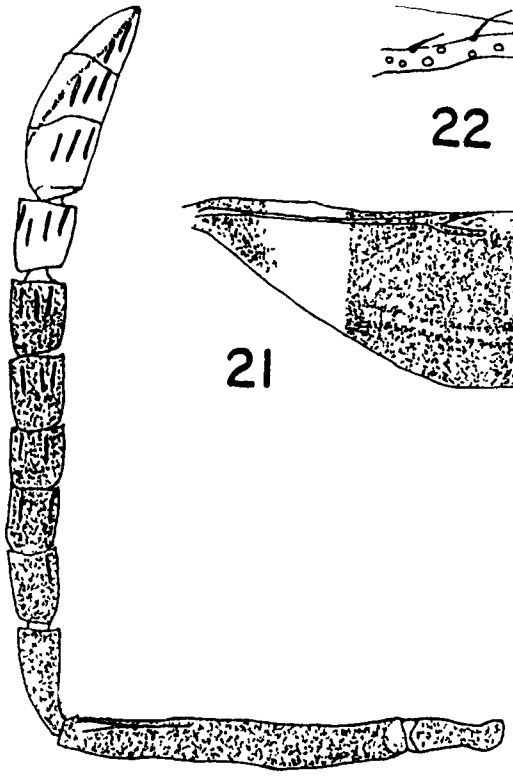
8

10 9 11

Figs. 12 - 19. (12 - 14) *Homalotylus longipedicellus* (Shafee & Fatima), female: 12, antenna; 13, forewing, 14, venation of forewing, enlarged. (15) *H. tumkurensis* (Shafee & Fatima), female: antenna. (16 - 19) *H. flaminius* (Dalman), female: 16, antenna; 17, forewing; 18, distal venation of forewing, enlarged; 19, head frontal.


13
14
12
15
17
18
19
16

Figs. 20 - 29. (20 - 24) *Homalotylus albiclavatus* (Agarwal), female except fig. 24: 20, antenna; 21, forewing; head frontal, with enlarged mandible; 24, antenna, male. (25 -29) *H. turkmenicus* Myartseva, female, except fig. 29: 25, head frontal; 26, antenna; 27, sculpture of mesoscutum, area 0.029 sq.mm; 28, sculpture of scutellum, area 0.029 sq.mm; 29, antenna, male.



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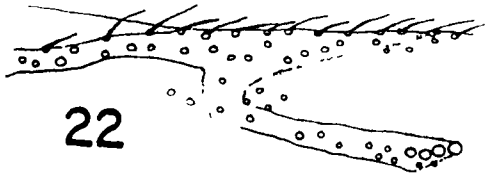

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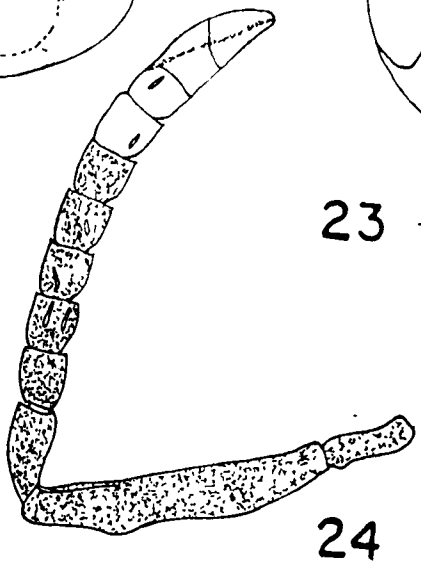

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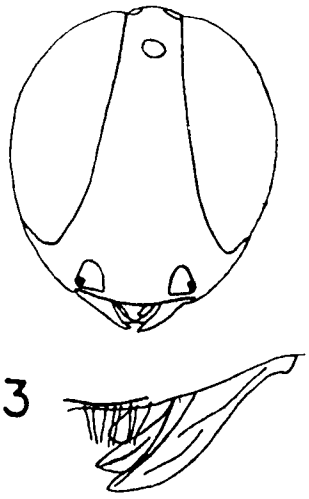

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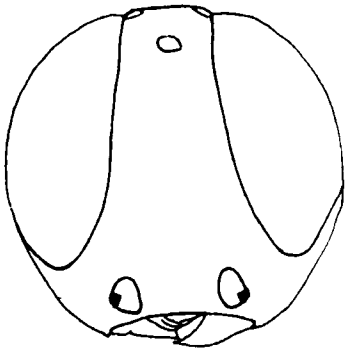

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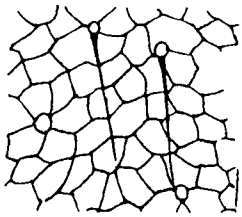

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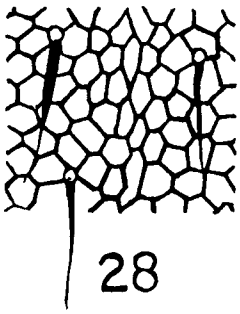

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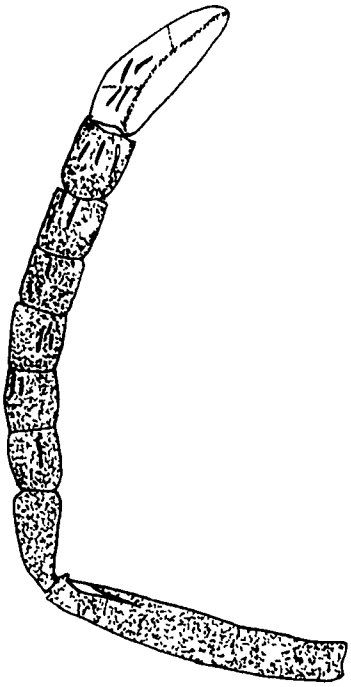
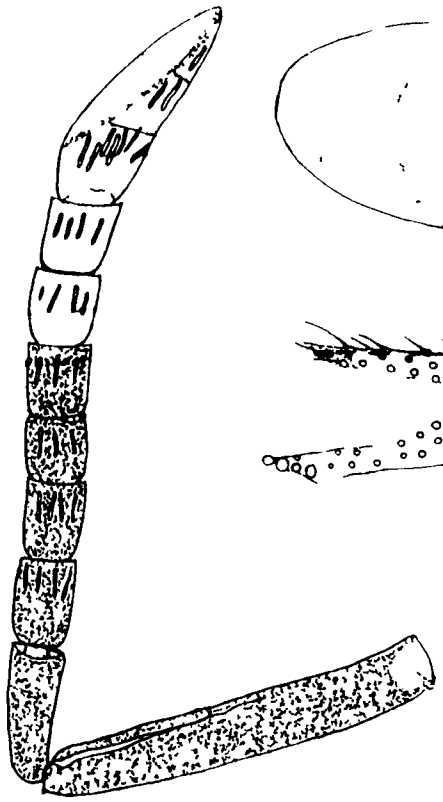


29

Figs. 30 - 39. (30 - 33) *Homalotylus scymnivorus* Tachi⁀kawa, female except fig. 33: 30, antenna; 31, forewing; 32, distal vination of forewing, enlarged; 33, antenna, male. (34 - 36) *H. ferrierei* Hayat, Alam & Agarwal, female: 34, antenna; 35, forewing; 36, distal venation of forewing, enlarged. (37 - 39) *H. indicus* (Agarwal); 37, antenna, male; 38, forewing, female; 39, distal venation of forewing, enlarged, female.



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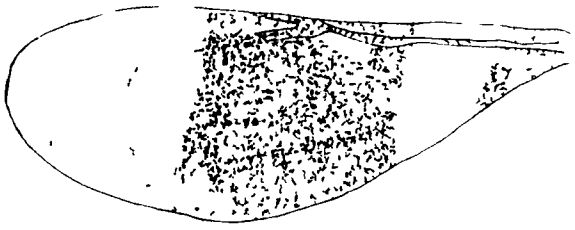

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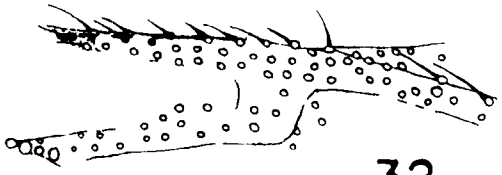

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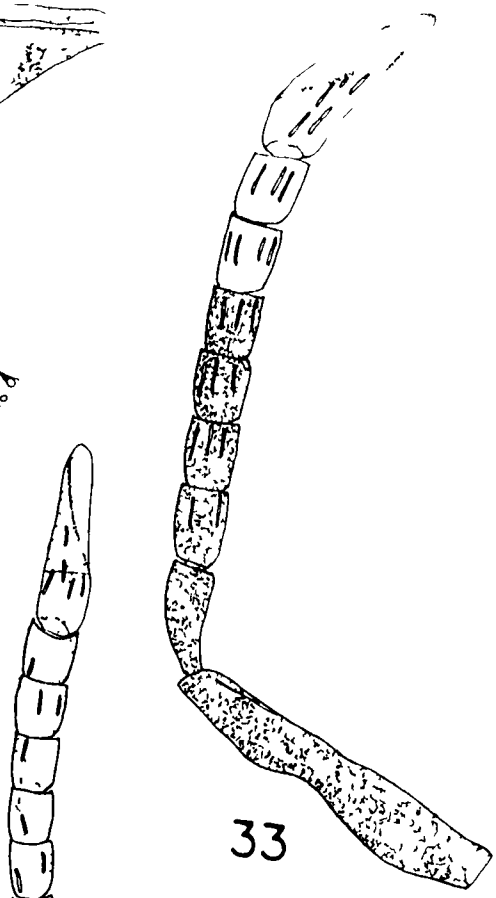

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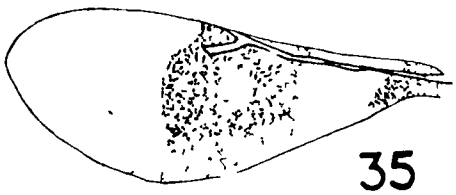

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34



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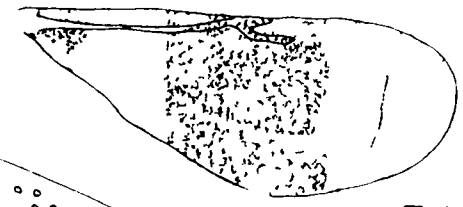

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